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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

March 27 through April 2, 1998

Summary 98-13

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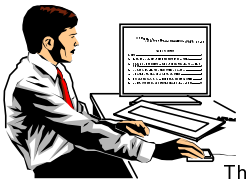

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EVENTS

1. WORKER IN CRITICAL CONDITION AFTER ACCIDENT AT AMES LABORATORY

On March 27, 1998, personnel at the Ames Laboratory Technical and Administrative Services Facility reported that a supervisor of electrical services was severely injured when part of his clothing apparently became entangled with a rotating shaft on a supply fan. The supervisor and another worker were inspecting a duct smoke detector located inside a supply fan room of an air-handling unit. According to the occurrence report, they turned the supply fan off at a control panel outside the supply fan room, then entered the room before the fan came to a complete stop. The supervisor carried a short ladder into the room and moved around the shaft-end of the fan housing so he could access the smoke detector. Investigators believe that part of his clothing came in contact with the still rotating shaft and became entangled. The supervisor was air-lifted to a regional hospital where doctors performed life-saving surgery and subsequent surgery to save his arms. The supervisor remains hospitalized in critical condition with head trauma and tissue damage to both arms. The Chicago Operations Office appointed members to a Type B Accident Investigation Board and sent them to Ames Laboratory to investigate the accident. OEAF engineers will follow the accident investigation and provide information as it becomes available. (ORPS Report CH--AMES-AMES-1998-0002)

KEYWORDS: rotating equipment, injury, ventilation, Type B investigation

FUNCTIONAL AREAS: Industrial Safety

2. ELECTRICIANS BURNED WHEN AEROSOL CLEANER IGNITES

On March 27, 1998, at the Los Alamos National Laboratory Accelerator Complex, two electricians received burns to their hands and faces when vapors from an aerosol electrical contact cleaner they were using contacted an electrical space heater, ignited, and formed a fireball. They were using the cleaner while performing maintenance on two electrical transformers. A supervisor took the electricians to the Los Alamos Medical Center where they were treated for first and second degree burns and released. Investigators determined that the electricians were wearing long pants, jackets, and safety glasses but had removed their gloves to perform intricate work. Investigators determined that use of the space heater was not specified in the work package and they believe that no one performed a chemical hazard analysis before the electricians began work. Failure to perform a job hazard analysis resulted in two electricians receiving first and second degree burns on all exposed skin and one lost workday. (ORPS Report ALO-LA-LANL-ACCCOMPLEX-1998-0005)

Investigators determined that the power in the building was de-energized, so the electricians set up portable lights near a roll-up door in accordance with the work package. Because it was cold, the electricians also set up a space heater in front of the lights. Investigators determined that the room contained shielding blocks that were stacked 8 feet high with a 4-foot gap between the blocks and the ceiling and formed a small L-shaped space around the transformers. Investigators believe that this configuration allowed the vapors to accumulate in the area. Because the vapor of the aerosol cleaner (hexane) was heavier than air, it settled to the floor, and the space heater ignited it within a few minutes after the electricians had finished spraying it. Investigators believe

that no one reviewed the material safety data sheet for the cleaner during preparation of the work package. However, the electricians did read the chemical information on the can stating that the contents were flammable under spill conditions. The material safety data sheet requires using the cleaner in a ventilated area and states that all sources of ignition must be removed before use. It also requires workers to use self-contained breathing apparatuses, neoprene gloves, and chemical worker goggles. The facility manager continues to review this event, including whether the workers had access to any type of communication device to notify their foreman during an emergency. Corrective actions will be developed when the investigation is complete.

NFS has reported similar events where the work control process failed to adequately address job hazards in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-08 reported that a welder at the Oak Ridge K-25 Site was fatally injured when his anti-contamination clothing and coveralls caught fire. The welder was using a cutting torch in a contaminated cell area and was wearing multiple layers of protective clothing, a respirator, and a welder's mask. DOE appointed a Type A Accident Investigation Board to investigate the welder fatality. Board members found that concerns regarding the contamination hazard may have caused the use of a level of protective equipment that impeded the welder's response to the actual, but unrecognized, hazard of clothing ignition. (ORPS Report ORO--LMES-K25GENLAN-1997-0001, and *Type A Accident Investigation Board Report on the February 13, 1997, Welding/Cutting Fatality at the K-33 Building, K-25 Site Oak Ridge, Tennessee*)

- Weekly Summaries 96-04 and 96-05 reported that a mason tender at Los Alamos National Laboratory received a severe electrical shock that resulted in serious burns and cardiac arrest. The mason tender was excavating in a building basement when the jackhammer he was operating contacted an energized 13.2-kV electrical cable. Facility managers critiqued the event and determined that safety engineers had not performed a review to identify health and safety hazards before the job started. (Type A Accident Investigation Board Report on the January 17, 1996, Electrical Accident with Injury in Building 209, Technical Area 21 Los Alamos National Laboratory; ORPS Report ALO-LA-LANL-TSF-1996-0001)

- Weekly Summary 96-05 reported that two operators and a health physicist at Hanford Analytical Laboratory were exposed to hazardous vapors while working in a contamination confinement structure. The exposure was a result of operators wearing powered air purifying respirators that were inappropriate for the confined atmosphere. Investigators determined that the material safety data sheet for a stripcoat that the operators were using was not reviewed during preparation of the work package or during the pre-job briefing. (ORPS Report RL--WHC-ANALLAB-1996-0006)

OEAF recommends performing hazard assessments. Hazard assessments are valuable for identifying inherent or potential hazards that may be encountered in the work environment. The

Health and Safety Plan Guidelines, developed by the Office of Environmental Management, identify the following four elements that should be included in a hazard assessment.

- identifying the operation or job to be assessed
- dividing the job or operation into constituent tasks
- identifying the hazards associated with each task
- determining the necessary hazard controls

Evaluation and identification of hazards must be an on-going process and should be performed for the following job phases.

- initially, during the work planning phase
- immediately when the work process or job starts (This assessment should be a more detailed, "real time" evaluation and should be used to further define existing hazards and to aid in the selection of appropriate engineering and administrative controls.)
- before any change in the job, task, or process
- as required by changing work conditions
- continually, as appropriate

Managers and supervisors in charge of job performance should conduct routine inspections of their work sites to identify new or previously overlooked hazards. Managers and supervisors should also look for any failures to control known hazards. The *Health and Safety Plan Guidelines* document is available at url http://tis.eh.doe.gov/docs/hasp.

These events underscore the importance of using effective work control and job-planning practices and performing complete evaluations of potential hazards. Safety and health hazard analysis must be included in the work control process to help prevent injuries and exposures to changing environmental conditions and chemicals. Safety and health hazard analysis should include information such as permissible exposure limits, thermal data, and current material safety data sheets. Physical data (such as area temperature, ventilation sources, and chemical flash points) should be included in the work control process to help prevent injuries and exposures to hazardous environments or chemicals. In this event, the electrician's use of a space heater introduced a hazard that was not addressed in the work package. Had work package prepares or reviewers been aware that a space heater was needed, they could have identified the hazards involved in its use. Work package preparers and reviewers should ensure that environmental hazards are evaluated for changing conditions, including temperature, pressure, wind, and rain. Facility managers should review procedures for preparing work packages to ensure that the reviews are performed correctly and changing environmental conditions are identified.

- DOE O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, states that the contractor must identify workplace hazards and evaluate the risk of associated worker injury or illness.

- DOE O 4330.4B, *Maintenance Management Program*, section 8.3.1, provides guidelines on work control systems and procedures. The Order requires using control procedures to help personnel understand the requirements for working safely.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling and Coordination of Maintenance at DOE Nuclear Facilities*, section 3.1.1.3, provides

the key elements of an effective planning program. Included is guidance on consistency in planning between disciplines to avoid confusion and frustration of work groups. The standard also discusses the need for thorough reviews of work packages by experienced individuals to eliminate errors. Managers at DOE facilities should review their planning programs and policies to ensure consistency with the guidance in the standard.

KEYWORDS: work control, burn, chemical, combustible materials

FUNCTIONAL AREAS: Hazards Analysis, Work Planning, Industrial Safety

3. WORKER RECIEVES PUNCTURE WOUND AT HANFORD

On March 25, 1998, at the Hanford Site, a radiological control technician detected radiological contamination on a wound a worker received while removing radiologically contaminated debris from the N-Basin pool. The worker was not aware that his hand was wounded until he exited the area, removed his gloves, and noticed blood on a cotton glove liner. The radiological control technician immediately surveyed the wound and detected radiological contamination within the wound area. The worker is being evaluated for potential internal contamination. The worker violated the activity hazard analysis and used gloves that were not sufficient to resist puncture, resulting in a radiologically contaminated wound to his hand. (ORPS Report RL--BHI-NREACTOR-1998-0010)

Investigators determined that work planners conducted an activity hazard analysis and determined the job required the worker to wear leather outer gloves. The worker believed that leather outer gloves were inappropriate for the wet conditions he knew existed inside the work area, so he did not put them on. Instead, he wore two pairs of thick, rubber elbow-length gloves.

Decontamination technicians at a mobile decontamination trailer could not adequately decontaminate the wound, so the worker was sent to the Hanford Environmental Health Foundation, where other technicians attempted to completely decontaminate it. After these attempts, they were still able to detect the presence of beta/gamma contamination in the wound. The Health Foundation medical director directed that the worker be taken to an emergency decontamination facility to finalize decontamination of the wound. The medical director has not yet determined the committed effective dose equivalent the worker received.

NFS has reported similar events where personal protective equipment did not provide adequate protection in several Weekly Summaries. Following are some examples.

- Weekly Summary 95-47 reported that two chemical operators were loading pieces of contaminated equipment for disposal at the Oak Ridge National Laboratory. While manually handling the small, sharp-edged pieces, one operator noticed a cut in his outer anti-contamination glove. When the operator removed his personal protective equipment, he discovered that all three layers of gloves were cut, and he had a small skin abrasion that was not bleeding. The radiological control technician decontaminated the operator's hand and placed him on a bioassay program, which showed that he had an uptake of Sr-90, Cs-137 and Cm-244. This was projected to cause a committed effective dose equivalent of 112 mrem and a committed dose equivalent to the bone surface of 1,950 mrem. (ORPS Report ORO--MMES-X10METCER-1995-0004)

- Weekly Summary 94-35 reported that a plutonium worker at the Los Alamos National Laboratory Chemistry and Metallurgy Research Facility accidentally punctured the glove-box glove and the backside of her left thumb with the file. The wound count indicated 8.58 nanocuries of plutonium-239 inside the wound. After non-intrusive decontamination methods were unsuccessful, a physician performed three excisions reducing the contamination to 0.46 nanocuries. (ORPS Report ALO-LA-LANL-CMR-1994-0022)

- Weekly Summary 94-02 reported that a separations operator at the Savannah River HB-Line Plutonium-Oxide facility suffered a puncture wound in his left index finger while working in a glovebox. Health Physics personnel surveyed the operator and detected no internal or external contamination. The operator punctured his finger while passing a rodding wire from one hand to the other. As required by the applicable radiation work permit, the operator was wearing two sets of coveralls, two sets of surgeon gloves and one pair of cloth glove liners. Skin surveys and a blood disk smear showed no detectable contamination. (ORPS Report SR--WSRC-HBLINE-1994-0001)

These events illustrate the need for personnel to exercise extreme care when working with or near sharp objects in contaminated environments. The events also underscore the need for radiation safety personnel to evaluate potential hazards from sharp objects when specifying required protective clothing.

Wounds in radiologically contaminated areas can present a serious hazard to the people involved and may require surgical excision, medical treatment, and monitoring. Most such accidents can be avoided through thorough job planning, including careful task analysis, provision of appropriate tooling and protective devices, awareness of the work environment, and attention to detail. Radiological control managers and facility managers should assess the level of personal protective equipment and clothing necessary for radiological work activities that include other hazards, such as handling sharp objects.

- DOE/EH-0256T, rev 1, *Radiological Control Manual*, chapter 3, “Conduct of Radiological Work,” provides guidance for selection of personal protective equipment and clothing. Appendix 3C, “Contamination Control Practices,” states that protective clothing, as prescribed in the radiological work permit, should be selected based on the contamination level in the work area, the anticipated work activity, worker health considerations, and regard for non-radiological hazards that may be present.

- DOE 0 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*, states that the contractor must identify workplace hazards and evaluate the risk of associated worker injury or illness. When a hazard is identified, managers must assess the process and take appropriate steps to prevent, abate, or mitigate the hazard.

- 10 CFR Part 835, *Occupational Radiation Protection Radiation Safety Training,* requires training and periodic retraining in (1) general radiation safety for all workers, (2) fundamentals of radiation protection and as low as reasonably achievable principles for all radiological workers, and (3) fundamentals of radiation protection and procedures for maintaining exposures as low as reasonably achievable for radiological control technicians.

- DOE/EH-0566, *Worker Involvement Lessons Learned and Good Practices From Idaho National Engineering and Environmental Laboratory Disposition Activities,* discusses the importance and benefits derived from worker involvement on a daily basis in work planning activities, hazard identification and analysis, and post-job review. In one example, workers were having problems with the standard leather Kevlar gloves (i.e., the knitting was not puncture resistant). Workers brought up the complaint in a pre-job briefing and a more suitable, rubber-impregnated glove was found and purchased. This solved the puncture problem and gave the workers more dexterity and slip resistance over the leather/Kevlar combination. For copies of the report, contact Andrew W. Mikkola, DOE-ID, at (208) 526-0725; Anthony F. Kluk, DOE Headquarters (DOE-HQ), Office of Northwest Area Programs (EM-44), at (301) 903-3744; or George E. Destis, DOE-HQ Office of Field Support (EH-53), at (301) 903-1488.

The event discussed in Weekly Summary 95-47 was also addressed on the Lessons Learned List Server. The List Server report discusses the special hazards confronted when personnel handle sharp, contaminated objects and how such hazards must be addressed in radiological work planning. Sharp, contaminated objects should be pre-packaged using remote-handling tools. Cut-resistant gloves may reduce the possibility of penetrating personal protective equipment. Close attention to detail during radiological control work will limit contamination. The DOE Lessons Learned Information Services Home Page provides access to the list server and is located at URL http://tis.eh.doe.gov:80/others/ll/ll.html.

KEYWORDS: internal contamination, personal protective equipment, radiation protection

FUNCTIONAL AREAS: Radiation Protection, Work Planning

4. MISCOMMUNICATION LEADS TO CRITICALITY LIMIT VIOLATION

On March 24, 1998, at the Los Alamos National Laboratory Plutonium Processing and Handling Facility, a weapon component technology room supervisor notified a deputy division director of a glovebox criticality safety limit violation. The director and the facility criticality safety committee chairman determined that the total amount of nuclear material for the glovebox had been exceeded by 253 grams. They removed one item from the glovebox to reduce the total quantity of material below the criticality safety limit value. Investigators determined that the violation occurred 5 days earlier when a technician moved material into the glovebox because of a communication error. Failure to communicate properly led to a criticality safety limit violation. (ORPS Report ALO-LA-LANL-TA55-1998-0008)

Investigators determined that on March 19 a technician moved additional material into the glovebox and exceeded the criticality safety limit. They also determined that the technician had telephoned the room supervisor to ensure that no limits would be violated by the movement. The supervisor thought that the technician's questions were about the material she was going to move, but the technician's intent was to determine if the movement would exceed any glovebox limits. Investigators determined that the technician believed that the room supervisor had confirmed that the movement would not violate any limits. They also determined that the room supervisor checked a material accountability system and that after the transfer some one entered it into the system. Investigators determined that the accountability system does not provide any warnings when limits are approached or exceeded because, depending on the number of different configurations and items in the glovebox (various isotopes, forms, shapes, and quantities), the limits are subject to change. They also determined that facility personnel must use a combination

of process knowledge and information from the material accountability system to determine when limits will be approached or exceeded.

The facility manager held a critique of this event. Critique members determined that, although the glovebox total quantity was exceeded, it did not approach the point where an actual criticality was of concern. They also determined that no plutonium isotopic content limits were exceeded. In addition, they determined that the director and chairman may have violated a facility procedure when they moved the material out of the glovebox. Although the facility manager believes that the technical decision to move the material was a correct one, the procedure suggests that certain personnel should be present during material movements. The procedure does not clearly indicate whether the director or chairman needed other personnel to be present before they moved the material because the applicable statement is not presented as a requirement. The facility manager determined that the procedure should be clarified regarding required personnel for material movements. Corrective actions to address the communication error continue to be developed.

NFS has reported events caused by miscommunications in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-21 reported that a process specialist at the Rocky Flats Environmental Technology Site incorrectly removed 19 criticality safety infraction warning postings. The process specialist was supposed to remove only the postings associated with raschig-ring tanks. However, the process operations manager who assigned the task did not specifically indicate which postings to remove, and the list he gave the specialist included every criticality infraction for the building. This breakdown in communications resulted in removing criticality postings that affected over 15 rooms within the building. (ORPS Report RFO--KHLL-771OPS-1997-0024)

- Weekly Summary 97-03 reported that the South Carolina Department of Health and Environmental Control issued a Notice of Violation to Westinghouse Savannah River Corporation and the Department of Energy, Savannah River Site, for a violation of the site National Pollutant Discharge Elimination System permit. The notice cited failure to submit valid test results for acute toxicity and fecal coliform at two discharge outfalls for the November 1996, discharge monitoring report. Investigators determined the apparent cause was lack of communication between the laboratory and the field engineer. (ORPS Report SR--WSRC-ESH-1997-0001)

- Weekly Summary 96-50 reported that Manufacturing Division personnel at the Pantex Plant, identified a production technician who had performed work without being fully qualified during a review of personnel qualification/certification records. The technician had completed all required job-specific training, but lacked courses on general work practices required by plant procedures. Investigators determined the cause was miscommunication between the operations coordinator and operations manager about the technician's qualifications. (ORPS Report ALO-AO-MHSM-PANTEX-1996-0236)

These events underscore the importance of using effective work control practices to provide multiple levels of protection. In this event, effective communications were relied upon to prevent a criticality limit violation. When this barrier broke down there were no other effective barriers to prevent the violation. Although effective communication is important and necessary, it is not an effective barrier by itself. The *Hazard and Barrier Analysis Guide*, developed by OEAF, discusses

barriers that provide controls over hazards associated with a job. Barriers may be physical barriers, procedural or administrative barriers, or human action. The reliability of barriers is important in preventing undesirable events such violation of criticality limit. The reliability of a barrier is determined by its ability to resist failure. Barriers can be imposed in parallel to provide defense-in-depth and to increase the margin of safety. The *Hazard and Barrier Analysis Guide* provides a detailed analysis for selecting optimum barriers, including a matrix that displays the effectiveness of different barriers in protecting against some common hazards. A copy of *The Hazard and Barrier Analysis Guide* is available at URL http://tis.eh.doe.gov:80/web/oeaf/tools/hazbar.pdf. DOE-STD-1031-92, *Guide to Good Practices for Communications*, discusses the need for clear, formal, and disciplined communications and provides guides to improve communications such as repeat backs and confirmation. DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Nuclear Facilities*, provides information on work controls and coordination.

Facility managers should ensure that work controls are rigorous enough to allow workers to complete jobs safely and efficiently without relying solely on communications. The responsibility for ensuring adequate control of work activities resides with line management. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter II, states that the on-duty shift supervisor should maintain authority and responsibility for all facility operations. Facility managers and supervisors should ensure plan-of-the-day meetings or pre-job briefings are performed so the responsibilities of personnel are clearly defined and the expectations of the task are correctly understood by all parties.

KEYWORDS: posting, nuclear criticality safety, work control, communication

FUNCTIONAL AREAS: Nuclear/Criticality Safety, Operations

5. ELECTRICIAN BURNED WHEN BREAKER MANUAL TRIP BUTTON BREAKS

On March 28, 1998, at the Savannah River Site, an electrician received second degree burns to his hands and face when the manual trip button on a 480-volt breaker cracked and came apart, allowing the mechanical linkage to contact energized parts and cause an electrical arc and flash. An off-site physician treated the electrician's burns, and the electrician returned to work the following day. The facility manager instructed electricians to de-energize and inspect similar breakers in the facility. Electricians found one other breaker with a damaged manual trip button. The site maintenance engineering manager issued a site-wide advisory directing personnel at facilities with similar breakers not to use the manual trip button. Failure of the trip button resulted in an electrical arc and injury to an electrician. (ORPS Report SR--SRC-POD-1998-0002)

Investigators determined that the electrician had restored power to the facility following corrective maintenance of a 13.8-kilovolt bus. Before he left the area, the electrician noticed that the manual trip button on the 480-volt breaker was not correctly aligned with a hole in the panel. The electrician told investigators that he had seen this happen numerous times, so he attempted to align the button with the hole. While he was working on the breaker, the button cracked and came apart. The mechanical linkage contacted energized parts inside the breaker, causing the electrical arc and flash. Investigators also determined that workers performed preventive maintenance on the breaker on September 4, 1997, and that the breaker had been retrofitted with an ASEA Brown Boveri SS-4 solid-state trip device during the preventive maintenance.

On March 29, 1998, the Savannah River site maintenance engineering manager issued a site-wide memorandum advising all personnel not to use the mechanical trip button on ITE KA, KB, and KC breakers. The memorandum also directs personnel to use the breaker handle to open or close it. The memorandum states that the on-going investigation has not raised any concerns about whether the breaker can perform its designed operation. On April 1, 1998, the Savannah River Site lessons learned coordinator put a description of this event on the DOE lessons learned list server (identifier 1998-SR-WSRC-LL-0001). The Savannah River Site lessons learned coordinator recommended that facility managers across the complex "consider inspecting breakers with manual trip buttons to ensure linkage and push-buttons are not susceptible to this type of failure." The DOE Lessons Learned Information Services Home Page provides access to the list server and is located at URL http://tis.eh.doe.gov:80/others/ll/ll.html. To obtain additional information about this occurrence can call Bill McEvoy at (803) 952-9900.

NFS has reported similar electrical switchgear problems in several Weekly Summaries. Following are some examples.

- Weekly Summary 96-20 reported that electricians at the Advanced Test Reactor discovered an electrical shock hazard during operation of a 480-volt motor control center reset button with the contactor in the NOT TRIPPED position. They determined this situation could result in a short between a load lead on the contactor and the panel front cover, placing the operator at risk of electric shock. (INEL Lessons Learned No. 96237)

- Weekly Summary 94-17 reported that personnel at the Savannah River Site breaker shop installed an SS-4 solid-state trip device retrofit kit, manufactured by ASEA Brown Boveri, in an ITE KC, 480-volt breaker. When electricians installed the breaker in the switchgear cubicle and racked it into the connected position, the manual trip push-button rod contacted the c-phase internal bus, drew an arc, and caused a fault to ground through the breaker frame. The reconfigured bus work may not have allowed adequate clearance between the mechanical trip button linkage and energized parts following this retrofit. It was possible for the manual trip linkage to contact the bus bar during normal operation of the trip pushbutton. This event was the result of a design problem with the SS-4 retrofit kit and has since been corrected.

This event underscores the importance of maintenance personnel being aware of equipment aging problems. Although it is often impossible to predict the failure of any component, the following references provide some useful guidance for facility managers to use when maintaining aging equipment.

- DOE-STD-1073-93, *Guide for Operational Configuration Management Program,* discusses the importance of conducting aging-degradation evaluations and determining the present material condition of components.

- DOE 4330.4B, *Maintenance Management Program,* discusses establishing programs for the management and performance of effective maintenance and repair. Section 5.2 of the Order addresses planned preventive maintenance to ensure equipment operates within the designed operating conditions. The Order includes guidance for incorporating vendor recommendations to predict component degradation and allow for replacement before failures.

KEYWORDS: breaker, burn, electrical fault

FUNCTIONAL AREAS: Electrical Maintenance

6. WORK PACKAGE ERROR LEADS TO LOSS OF GENERAL ALARM

On March 26, 1998, at the Savannah River Site F-Area Tank Farm, a control room operator discovered that a general alarm in an unmanned area was not received at the control room as expected during routine conductivity probe checks. Investigators determined that the operator did not receive the alarm because a worker lifted the alarm leads during performance of a design change work package and left them that way when he completed the work. An error in the design change work package led to the worker lifting the leads. The shift manager immediately initiated the actions required for a limiting condition for operation for loss of continuous, remotely monitored radiation monitoring. He also initiated a new work package to re-land the alarm leads. The degraded alarm condition could have caused a delay in responding to a high-radiation alarm condition in a remote part of the facility. (ORPS Report SR--WSRC-FTANK-1998-0008)

Investigators determined that the general alarm area is not continuously manned. If an alarm is received in that area, a general alarm is sent to a continuously monitored control room to alert operators to an alarm situation. Investigators also determined that a worker had recently performed a design change work package that required him to land leads on a terminal strip behind the control panel in the unmanned area. They determined that work planners provided the worker with a design change work package that included a “before” drawing that did not show the general alarm leads. They also determined that the worker lifted the alarm leads to make the as-found conditions match the design change work package instead of stopping work when he discovered the discrepancy.

NFS has reported similar occurrences involving inadequate procedures in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-26 reported that an operator at Savannah River inadvertently backed a front-end loader into a guy wire causing it to break. The cut wire contacted a 13.8-kV transformer, short-circuiting it. Investigators determined that the work package did not address safe working distances from wires and that a spotter was not used during this activity. (ORPS Report SR--WSRC-SLDHZD-1996-0029)

- Weekly Summary 97-03 reported that a subcontractor communications technician at the Oak Ridge Y-12 Site inserted a “fish tape” into the wrong conduit where it contacted an energized 13.8-kV electrical switch box. The technician was installing communication cables using approved work package drawings. However, one of the drawings incorrectly showed a 4-inch conduit, rather than the 3-inch one the technician was supposed to access. An incorrect drawing resulted in an electrical near miss. (ORPS Report ORO--USW-ORFICNY12-1997-0001)

These events underscore the importance of developing a good work package. Discrepancies between planned conditions and as-found conditions can result in confusion and increase the potential for errors in work package execution. Walk-downs are an effective means to make sure planned conditions reflect conditions in the field. These events also underscore the importance of following work package steps. If conditions found are not as outlined in the work package, work

should be stopped immediately and, if necessary, changes should be made to the work package using approved change control methods. The following references discuss operations and technical procedures and should be used as guidelines to write an effective work package.

- DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers across the DOE complex in producing accurate, complete, and usable technical procedures that promote safe and efficient operations. This guidance can also be applied to other technical documents such as work plans. Section 2.3, "Facility Configuration," requires walk-downs, simulations, modeling, or desk-top reviews to ensure procedures are technically accurate and adequate.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling and Coordination of Maintenance at DOE Nuclear Facilities,* section 3.1.1.3, provides the key elements of an effective planning program. The standard includes guidance recommending that experienced individuals conduct thorough reviews of work plans to eliminate any errors or confusion.

KEYWORDS: work planning, configuration control, alarms

FUNCTIONAL AREAS: Work Planning, Configuration Control